Living Green: Vermicomposting
Modest effort, greater impact

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This paper is prepared based on the related literatures, research and practical experience of the author over 20 years. The author designed, tested and trained more than 10,000 household members and farmers in vermi-composting techniques. Few private entrepreneurs and farmers are trained in manufacturing vermi-composting bin and producing locally adapted vermis/worms respectively. The bin and vermis/worms produced locally, have been proved to be suitable for Nepal. The bin manufacture company has already sold more than 2,000 vermin-composting bins.
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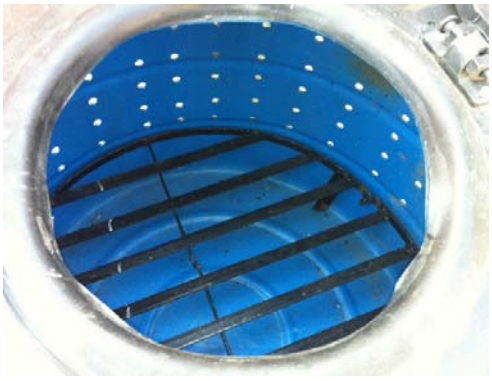
Introduction

The description here is focused on small-scale vermicomposting system that is useful at household level. Vermi-composting is an easy way to make a great positive environmental impact by reducing the amount of green-waste that finds, otherwise, its way into landfills, roadside, public places and in many cases in the river or ocean. The resulting nutrient-rich compost (an end product) is an environmentally sound amendment to enrich soil for plant growth.

Vermi-composting process uses different types of earthworms and other micro-organisms to eat degradable wastes, such as kitchen scraps, papers, cottons, cartoons, plant scraps and other degradable waste materials. Vermicomposting is much faster, eco-friendly and effective than the traditional composting techniques. It can be managed in a very small space to an industrial scale as per the need. This composting process produces negligible or no odor at all. The bin can be placed outside the house, car-porch or garage or in the garden. It is very simple and low-maintenance waste processing method usable almost anywhere people live, including urban environments with limited space.



Earth-worms and vermis

More than 4,000 distinct species of earthworms have been identified and named by the researchers. Only a few of these worms are found in Nepal or in any other country, and not all of these are useful for vermi-composting. The most known worms are soil-dwelling worms, and their primary job is soil aeration, but not composting. These are commonly known as earthworms, their length ranges from 2 to 8 inches. If you dig a hole in your garden or in kitchen-garden and find a large worm, it is most likely a soil-dweller. They prefer the cooler temperatures and are found in the soil and often come to the surface to consume organic matter after a heavy rain. These earthworms or soil worms require soil to survive — should not put them in a vermi-composting bin. It is difficult for them to find or adjust their preferred environment inside the vermi-composting bin. Most importantly, they do not process food scraps as effectively as compost worms and you will find odor from the bin.

The worms (commonly called vermis) that are used in vermi-composting are very different than the soil-dwelling worms. They are related species, but they have different habit patterns and they play

different roles in the nature. Any worms that are naturally attracted to fresh organic wastes can be used for the vermi-composting purpose, but not all types. The primary job of compost worms is to eat degradable waste before degradation process starts and produce compost. These are relatively small, red-purple colored that prefer an environment of decaying organic matter other than soil. The vermis/worms consume large amounts of organic materials, reproduce quickly and adapt the environment of the bin. Commonly found vermis in Nepal are: *Eisenia fetida, Perionyx excavatus* (small, long), and *Lampito mauritii* (see photo above).

Vermi-composting bin

It can be as simple as a stack of plastic food-storage containers or as complex as an automated unit capable of processing hundreds of kilograms of organic matter daily. Water-tanks or any other similar plastic or ceramic container can be converted into to vermi-composting bin. A 200-liter capacity plastic tank can be sufficient for a family of 5-6 members (see picture above).

Preparing the bin

Vermis need bedding at the beginning in addition to their food. Shredded paper or newspaper, coir (coconut husk fiber), and shredded cardboard, cotton cloth, jute bag, leaves or fodder are good bedding materials. These bedding materials to be soaked with clean water and spread a 1-2 inch layer at the bottom of the upper section of the bin. After placing vermis (minimum 2,000) to the bedding, you should not touch and spread them out again. Then a small amount of food scraps to be placed and these needs to be covered by newspaper or bedding materials without blocking the side air vents.

The vermis/worms will get settled in their new home (your bin). Worm eggs (cocoons) in the worm 'starter' (inoculant) will hatch. Feed the worms a small amount (8-10 cups of fruit and vegetable scraps) when you start a bin and then nothing to be feed for about two weeks, but need to check and maintain the moisture. After two weeks, continue feeding them. This helps the worm population to begin to grow without initially overwhelming the system. As the mature vermis eat and grow, they will begin to lay eggs. Juvenile vermis will then appear, and the population will increase rapidly. In about 6 weeks, the immature vermis will mature and start laying eggs. Observing this population explosion can be an exciting and fascinating biology lesson.

Main products

There are 2 main valuable products of vermi-composting: one is organic compost and another is mineral-rich liquid. As there are few holes at the bottom of the bin from which excessive water and mineral-rich liquid come out. A small jar can be placed beneath the holes so that the liquid can be collected and used in the garden. It is very useful for high-value flowers like orchid and azalea and others. Both products have full of micro-nutrients.

After 8-10 weeks, you will start noticing vermis castings (rich, gray-brown, soil-like material) in the bin. The worms produce castings as they eat, filling the bottom section of the bin as they go. When the vermis/worms have worked through the green waste, you will be left with rich, organic compost, ready to enrich your garden soil for organic fruits and vegetables. Bin's upper and lower doors have to be kept closed to prevent mice and other insects to enter inside

the bin. It is amazing that a pound of vermis can eat up to 2 pounds of food scraps each day. As the vermis population grows, the amount of food that you can give them increases accordingly.

Bin environment and maintenance

Vermi-composting is user-friendly bio-technology with a lot of aesthetic, environmental and economic values. If done correctly, it can last for years, no need to add more vermis. The composting system will have a pleasant, earthy smell. In fact, the worms eat the bacteria that cause bad odors, therefore, it is almost odorless. If there is a smell, it indicates that the conditions are not right in the bin.

Vermis like damp and dark. They will die or try to escape if the bin is too wet or dry. Therefore, drainage holes may need to be checked periodically and clear any clogs. If the bin environment is well maintained, they always stay inside and do their job efficiently. Vermis are sensitive to light, therefore, should be placed in a shaded environment. If vermis/worms are trying to escape, it is a signal that conditions are not ideal inside the bin.

Compost worms (vermis) tolerate a wide range of acidity in their environment, but some types of vermis/worms prefer a just slightly acidic condition. It is possible for a bin to become too acidic, killing adult worms and preventing eggs from hatching. To be on safe side, limit amounts of acidic food scraps, such as pineapple, citrus, and tomatoes and do not put oil in the bin.

Over time, you may wish to buy another set of bins or share vermis with your neighbors, relatives and friends to start vermi-composting on their own. Compost vermis will never 'outgrow' in your bin, if its population gets too large, the worms will stop reproducing and their numbers will decrease naturally according to the bin size and the food supply. Thus, they maintain their eco-system.

Compost vermis/worms can tolerate a wide range of temperatures, but most work best at temperatures between 70 and 80°F. If the temperature is to dry and hot or freezing, you should protect your vermis/worms from temperature extremes. Temperatures inside the bin are generally lower than the surrounding air because the moist bedding and evaporation process creates a cooling effect, creating a mini weather system inside the bin. Ventilation, in the form of air vents, helps maintaining oxygen inside the bin. Vermi/worms need oxygen and produce carbon dioxide, just like human being. Each time the bin is opened to feed the vermi/worms air inside the bin is also refreshed.

Other organisms

Depending on the location of the bin, you may notice other critters in with the vermi/worms. These worm 'friends' are usually beneficial organisms in small numbers; they include springtails, mites, rove beetles, and millipedes, as well as microscopic bacteria and fungi, and these associated organisms enhance the composting process. Centipedes, however, are predators and should not be in your worm bin—if you find one, remove it carefully.

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FACE to FACE

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Shivana Shrestha

Shriya Khadka

pics courtesy: Dr. Adhikari

Living a green way

Living green is not an easy task, one has to put on a lot of hard work and dedication

Something that is good for the environment is good for everyone too. People tend to forget about environment in the process of fulfilling their own desires. Today, when we are struggling with the natural disasters, diseases and climate change, our little attempt could be a way to save ourselves and our future generations.

Dr. Damodar Adhikari is someone who believed in his passion of living in an environment-friendly way. His effort is clearly visible in his greenly managed house at Civil Homes phase III situated at Sunakothi, Lalitpur.

By profession, he is a development researcher and currently working in the health sector of Nepal. Adhikari, researched in the Philippines for more than a year on ecological waste management and believes that his life abroad influenced him to adapt a green living lifestyle. Just like it is said, "Charity begins at home," we could see that greenery began at his home and after that, Adhikari has been engaged in social activities and committees within his residency and other social clubs to manage and advocate about the importance of some basic components of green living.

"To live a green life is not costly. Instead it is an investment which provides returns in the long term both financially and aesthetically," says Adhikari who along with his wife Devi manage their home at their best in environment-friendly ways. They have been doing purely organic vegetable gardening, vermin-composting to manage degradable household wastes, bee keeping, rain water harvesting and solar drying for more than 10 years.

"We want to minimize and avoid this growing pollution problem but environmental degradation is a long-term effect and cannot be solved by itself unless every individual takes a stand for it. After all, change begins with individuals," he says.

Some of the details of the green life style of Adhikari couple are provided below.

Vermi -composting

Waste is not a problem in itself rather it's a critical management issue feels Adhikari, who practices vermi -composting to manage organic wastes produced in his home and provide technical assistance in the civil homes residency.

Vermi -composting is the process of using worms and micro-organisms to turn kitchen and other degradable wastes into black, odorless, nutrient-rich humus. Adhikari researched and designed a vermin-composting bin suitable to use at household level, imparted his knowledge and skills to the residents of civil homes-3 and others through coaching, presentation and practical sessions and introduced vermi -composting in the residency. He also trained a private manufacturer to make vermi -composting bins for wider benefit. Currently, more than 110 households have adopted the technology in the housing.

Vermi -composting uses certain types of earthworms (small, red-purple worms that prefer an environment of decaying organic matter rather than soil) and other micro-organisms that eat up waste materials such as kitchen wastes, garden leaves, and other degradable materials. It is a very simple composting technique that requires a bin with holes (for ventilation) which is known as a vermi -composting bin and certain types of earthworms (varieties commonly used in Nepal are: Eiscnia fctida, Perionyx excavatus, and Lampito mauritii) that eats up the degradable waste materials and converts these materials into great compost that is highly nutritious and useful for gardening or upstream farming.

For the first time, these vermi need bedding (grass leaves, news paper, cardboard, etc.) in addition to degradable waste materials (except citrus fruit/vegetable) for feeding. It requires three major elements that allow oxygen inside the bin through proper ventilation (holes), right level of moisture (about 70%) and temperature (between 70° to 80° F) and holes to flow odourless liquids, which is very nutritious for plants. Minimum of thousand earthworms (during summer) has to be kept in the bin at the beginning (with proper bedding materials) but eventually it will multiply really fast. Vermi -composting is one of the most sustainable ways to reduce the waste from household.

"A person in Nepal produces about one kg of waste per day out of which about 75% is degradable and rest about 25% can be minimized and/or managed easily. "So, at the end, it is really up to us to decide on what type of life we want to lead," says the Adhikari couple

fact file

Vermi -composting

- A promising and easy to use biotechnology. There is no problem of bad smelling while practicing vermi -composting, because the vermi eats the fresh waste materials (before it gets rotten) and the vermi also eat the bacteria that cause bad odours
- Vermi convert organic matter effectively (both physically and chemically) to increase the soil porosity, therefore, they are also called as 'ecosystem engineers'.
- Even though vermi can eat anything degradable (even jeans, cotton materials, hair, jute bags), lemon and other citrus fruits and meat should not be thrown in the bin as the leftover meats gives birth to insects that may eat the vermi resulting into reduced number of vermin in the bin.
- A pound of worms can eat up to two pounds of organic waste each day and as the worm population grows, the efficiency further goes up.
- The special type of earthworm (called vermi) are used for composting costs only one rupee per piece or less which later multiplies in numbers (in six weeks in summer) and remains lifelong, if suitable ecology is maintained.
- The vermi used in composting are light sensitive so there is no chance of those worms getting out of the bin. They prefer dark and damp place and loves eating all the time.
- These kinds of worms are rich sources of proteins and also vitamins and minerals; therefore, they can be the best animal feed supplements for poultry and fishery.

Dr. Damodar Adhikari and Devi Adhikari -

Solar Drier

The use of solar drier is environment-friendly and very efficient, and it also is a hygienic way of drying the foods and vegetables.

"Solar drier are very essential for places like Kathmandu where air carries more pollutants than oxygen. It also protects the food from insects and rain," says Devi. The food kept in the sun to dry are usually contaminated through polluted air. To prevent such contamination, and ensure the original taste and nutrient in food, the solar drier could be a good household tool. The solar driers are widely available in the markets these days with government subsidy.

Rain water harvesting and ground recharging

Water problem has taken over our lives and there is no other alternative to use of water. Having said that there is no replacement to water use, there is definitely proper alternative ways on using the sources of water. Tap water and underground water are the basic sources of water in the Kathmandu Valley. There is

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Vermi -composting is one of the key features of Dr. Damodar Adhikari's eco-friendly house in civil homes, Sunakothi

this other untapped option known to be Rain Water Harvesting which is the most efficient and ultimate way to reduce the problem of water scarcity that locals especially in Kathmandu Valley face these days. The harvesting of rainwater simply involves the collection of water from surfaces on which rain falls, and subsequently storing this water for the later use. Normally, water is collected from the roofs of buildings, filtered (using sand and gravel filter) and then stored in water tank(s).

Adhikari has installed two chambers in his home and made underground water tanks that can store up to 12,000 liters of rain water. The water collected pass through a basic filtration process where sands and pebbles are kept to ensure that water gets filtered. Adhikari along with his wife uses this source of water for the purpose of washing dishes, cleaning clothes, washing the car, watering the plants and flushing and cleaning the bathroom. The water collected throughout the rainy season leads to fulfill the need for about 7-8 months in a year.

"Washing clothes by rain water is easier and the clothes remain whiter than compared to the clothes washed by the use of underground water," says Adhikari. "It is because underground water contains more iron in it."

Similarly, making separate tanker for using in the toilet to flush results towards being less prone to water borne disease such as diarrhea (through possible contamination). The chances of drinking water to be contaminated if flush is directly linked with water tanks can also be higher. The bacteria may travel and reach up to the reservoir, according to Adhikari.

"To live a green life is not costly. Instead it is an investment which provides returns in the long term both financially and aesthetically"

Plastic free campaign

Besides the above-mentioned efforts, Adhikari has been actively advocating about reusing and reducing the use of plastics. He, along with other members of civil homes committee, has initiated durable shopping bags to help reduce the use of plastic bags. "We try to minimize the use of plastics in our home; we carry our own shopping bags and avoid bringing the unnecessary plastics and packaging materials with us," says Devi.

Organic Farming

While visiting the Adhikari couple's backside of house one can see a small vegetable farm, where every seasonal vegetable is grown along with some fruit trees. When asked about the secret behind such healthy and tempting vegetables, the couple told us it was the vermi -compost manure they used in the farm. Not only the manure but the pesticide they used to protect plant was made naturally at their own home. They used cow urine and herbal plants to make such environment-friendly pesticide which makes no harm to the plants, environment and human health. The best thing about the vegetables grown at the home are they are purely organic, tasty and fresh.

Bee- keeping

Bee- keeping is not usually observed in individual's home but the Adhikari couple has been successfully keeping two homes of bees. "Bees are good medium of pollination, they keep our vegetables and flowers healthy," says Adhikari. The couple has also been enjoying some honey produced by these bees.

The picture of eco-friendly home is clearly visible in Adhikari couple's home, the sincerity toward their passion of doing things in a natural way is also observed in the duo. If every household in the Kathmandu Valley follows Adhikari's way of living, the city would look different. Living green is not an easy task, one has to put on a lot of hard work and dedication. It could be a small effort or a revolutionary one but it would definitely affect the lives of many.

Practical training to Civilhomes residents (March 2011)